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**MAGNETIC HOLDING DEVICE AND METHOD**

This invention relates to a device and method for holding materials in place against a structure and is particularly, but not exclusively, concerned with retaining sheet materials in position against frame members of a building framework so that the sheet material can be secured to the frame members.

In the building industry it is often necessary to fasten sheets of material, such as insulating paper or sarking, to frame members of a wall or roof before the wall or roof is cladded or covered. When the sheet material is dispensed from a roll it can be difficult to hold the sheet material in position, particularly in windy conditions, until the sheet is secured to the wall or roof members, for instance by an adhesive or other fastening means.

It is therefore desirable to provide an effective holding device and method for holding materials, such as sheet materials, in position against a surface or framework of a building.

According to one aspect of the invention, there is provided a method of attaching a sheet material to a structure, said method comprising:

providing a plurality of magnetic holding devices each comprising a housing including at least one magnet and having a substantially flat magnetic surface on or in close proximity to said magnet;

placing the sheet material against at least one magnetically receptive surface of the structure;

placing said magnetic holding devices with said substantially flat magnetic surface against the sheet material to hold the sheet material in position between the magnetic surfaces of the holding devices and said at least one magnetically receptive surface of the structure so that the sheet material can be secured to the structure.

The magnetic holding devices preferably comprise elongate members, such as rods or tubes, each including at least one magnet. Preferably, each magnetic holding device has a plurality of magnets located at spaced intervals along the elongate member. At least some of the magnetic holding devices are preferably provided with at least one retaining member having a retaining

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surface extending along the elongate member at an angle, preferably generally perpendicularly to the substantially flat magnetic surface. The retaining members assist in preventing the magnetic holding devices and the sheet material from slipping relative to the frame members of the structure by engaging with surfaces of the frame members which extend at an angle to the magnetically receptive surface.

According to another aspect of the invention, there is provided a magnetic holding device comprising an elongate member including at least one magnet and having a substantially flat magnetic surface on or in close proximity to said magnet, whereby the elongate member is adapted to hold material between a magnetically receptive surface and said substantially flat surface, wherein at least one retaining member is provided on the elongate member, the retaining member having a retaining surface extending from the elongate member at an angle to the substantially flat magnetic surface.

The retaining member may be formed integrally with, or attached to an elongate housing for the magnet or magnets of the magnetic holding device. In a particularly preferred embodiment, an adjustable retaining member is provided having a part movable between an extended position in which it presents a lip having said retaining surface extending outwardly from the housing generally perpendicularly to the substantially flat magnetic surface, and a retracted position.

In one particularly preferred embodiment, the elongate member comprises a housing containing at least one pair of permanent magnets at longitudinally spaced apart positions of the elongate member. A piece of ferromagnetic material may be provided within the housing extending between said at least one pair of magnets so that when the elongate member holds a sheet against a ferromagnetic structural member, a strong magnetic circuit is created within the magnetic holding device and within the structural member, resulting in a stronger holding force on the sheet of material.

According to a further aspect of the invention, there is provided a magnetic holding device comprising an elongate housing member containing at

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least one pair of magnets at longitudinally spaced apart positions of the elongate housing member, and a ferromagnetic material extending between the pair of magnets within the housing.

The elongate member housing the magnet or magnets may be made of any convenient material, such as a wooden or plastics material. The or each magnet may be mounted on or received within a recess in the surface of the elongate member, with a surface of the magnet forming said substantially flat magnetic surface. Alternatively, the magnet or magnets may be housed within the elongate housing with a magnetic surface of the magnet being disposed in close proximity to a substantially flat outer surface of the elongate member forming said substantially flat magnetic surface of the device.

In one preferred use of the magnetic holding device, the elongate member is used to hold sheet material to surfaces of ferromagnetic frame members of a wall or roof framework, such as wall studs or roof purlins. The sheet material may be rolled into position against substantially flat magnetically receptive surfaces of the frame members with the holding devices being used to hold the sheet material in place until the sheet material is secured to the wall studs or roof purlins, e.g. by an adhesive or by fasteners.

When the magnetic holding devices are used in this manner, at least some of the holding devices may be positioned with retaining surfaces of the retaining members abutting against a side surface of a respective frame member that extends at an angle to the front surface of the frame member against which the sheet material is held. The retaining members thus help to prevent the magnetic holding devices and sheet material from slipping relative to the frame members.

Some preferred embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a perspective view illustrating a method of attaching sheet material to a wall framework in accordance with the invention;

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Figure 2 is a perspective view illustrating a method of attaching sheet material to a roof framework in accordance with the invention;

Figure 3 is a side perspective view of a magnetic holding device in accordance with the invention;

5        Figure 4 is a cross-section on the line 4-4 of Figure 3;

Figure 5 is a cross-section on the line 5-5 of Figure 3;

Figure 6 is an opposite side view of an end of the magnetic holding device of Figure 3 including an adjustable retaining member;

10       Figure 7 is a view similar to Figure 6 showing the retaining member in an extended position;

Figure 8 is a section on the line 8-8 of Figure 6;

Figure 9 is a section on the line 9-9 of Figure 7; and

Figure 10 is a side view of another embodiment of a magnetic holding device in accordance with the invention; and

15       Figure 11 is a side view of a modified embodiment similar to that of Figure 10.

Figure 1 illustrates two tradespersons 11, 12 utilising magnetic holding devices 20 in accordance with the invention to attach a sheet of insulating material 14 to vertical frame members 16 of a steel framework 18 of a building  
20 in accordance with the method of the present invention.

In the method of the invention, as shown in Figure 1, one trades-person 11 is holding one end of the sheet material 14 as the other tradesperson 12 unrolls the sheet material from a roll 15, alongside front surfaces 17 of steel frame members or wall studs 16. As the sheet material is unrolled, the magnetic  
25 holding devices 20 which comprise elongate rods containing magnets 30 are used to hold the sheet material 14 in position with the sheet material sandwiched between magnetic surfaces of the holding devices 20 and magnetically receptive front surfaces 17 of the steel frame members or wall studs 16.

Referring to Figure 2, there is illustrated a similar method in which the  
30 tradespersons 11, 12 are utilising magnetic holding devices 20 to hold a sheet of

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insulating material 14 to generally horizontally extending roof frame members or purlins 19 of a steel roof framework of a building.

Figures 3 to 9 show one preferred form of magnetic holding device 20 in accordance with the invention. The magnetic holding device 20 is in the form of an elongate rod having a pair of magnets 30 contained in an elongate housing 22. The elongate housing 22 may be conveniently formed from a molded plastics material, although the housing may be formed from other materials, such as wood or a metal such as aluminium. As shown in Figures 3 to 7, the elongate housing has an upper bulbous part 24 with rounded sides and a lower, narrower part 26 so that the magnetic holding device may be conveniently grasped by a user. Two short tubular extensions 28 extend from the lower surfaces of the part 26 and have recesses 29 within which the magnets 30 are housed. The lower surfaces 31 of the tubular extensions 28 thus provide substantially flat magnetic surfaces at longitudinally spaced apart locations of the housing 22.

Figure 5 shows the magnetic holding device 20 in use with the sheet material 14 held between the magnetically receptive front or upper surface 17 of a steel wall member 16 or roof member 19 and a magnetic surface 31 of the magnetic holding device 20.

A particularly advantageous feature of the magnetic holding device of the present invention is illustrated in Figures 6 to 9 which show an adjustable retaining member 40 provided on one side of the elongate housing 22 towards one end of the housing 22. Another similar retaining member 40 may be provided at the other end of the housing 22. The adjustable retaining member 40 comprises a circular body part 42 and a lip part 44 extending from one side of the body part 42. The circular body part 42 is attached to a side of the lower part 26 of the housing 22 by a threaded bolt 45 having an enlarged head 46 with a hexagonal recess 47 for receiving an a hexagonal key for tightening the bolt 45 in a threaded recess 48 in the side of the lower body part 26. The bolt 45 is preferably tightened to a sufficient extent to secure the adjustable retaining member 40 to the housing 22 while allowing the retaining member to rotate

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through approximately 90° about the axis of the bolt 45 between a retracted position as shown in Figures 6 and 8 and an extended position as shown in Figures 7 and 9. In the retracted position of Figures 6 and 8, the lip part 44 extends from the circular body part 42 substantially in the longitudinal, direction of the elongate housing 22, whereas in the extended position of Figures 7 and 9, the lip part 44 extends downwardly from the lower part 26 of the housing 22 for a greater distance than the short tubular extensions 28. The lip part 44 of the adjustable retaining member 40 may also have a ridge or rib 49 extending radially outwards from the circular body part 42 to assist a user in moving the retaining member 40 between its retracted and extended positions.

Referring more particularly to Figure 9, the lip part 44 in its extended position presents a retaining surface 41 extending beyond and generally perpendicularly to the substantially flat magnetic surface 31 of the holding device 20 for engagement with a side surface 39 of the steel wall member 16 or roof member 19 with the sheet material 14 therebetween. Figure 9 shows the sheet material 14 slightly depressed by the lip part 44 before it continues on to the next wall or roof member 16, 19 but it will be appreciated that the holding device 20 with the extended lip part 44 is also suitable for retaining the sheet material 14 to a corner member 116 of a steel framework 18 of a building.

The extended lip part 44 of the retaining member 40 helps to prevent the magnetic holding device 20 and the sheet material 14 from slipping relative to the wall or roof members 16, 19 and is particularly useful in windy outdoor conditions.

Figure 10 shows another embodiment of a magnetic holding device 50 mounted on an elongate tube or rod 51. The magnetic holding device 50 comprises an elongate tubular body part 52 and a pair of spaced cylindrical magnet housing members 54 extending outwardly from the body part 52 in a direction substantially perpendicularly to the axis of the tube or rod 51. The tubular body part 52 is slidably mounted on the tube or rod 51 and can be secured in a desired position on the rod 51 by a screw 53.

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The ends of the magnet housing members 54 have recesses 55 which house a pair of magnets 56 so that the end surfaces of the housing members 54 form magnetic surfaces 57 which are attracted to a magnetically receptive surface 61 of a steel frame member 60 to hold a sheet material 14 between the surfaces 57 and 61.

It will be appreciated that a plurality of the magnetic holding devices 51 may be mounted on an elongate tube or rod 51 for holding a sheet material 14 of large dimensions.

As shown in Figure 10, an adjustable retaining member 62 is mounted on each of the magnet housing members 54. Each adjustable retaining member 62 comprises a sleeve slidably mounted on a respective cylindrical housing member 54 and movable between a retracted position (as shown on the left hand side of Figure 10) and an extended position (as shown on the right hand side of Figure 10). In the extended position, a lip part 64 of the sleeve 62 extends beyond the magnetic surface 57 of the respective housing member 54 to present a lip surface for engagement with a side surface of the steel frame member 60 to help prevent the magnetic holding device 50 from slipping relative to the frame member 60, e.g. in windy conditions.

Each slidable retaining sleeve 62 may be secured in either its retracted or extended position by a screw 66 extending through a slot 67 in a lug 68 on the side of the magnet housing member 54.

Referring to Figure 11, there is shown a modified embodiment of a magnetic holding device 50 which is similar to that of Figure 10 with the retaining members 60 omitted so that the modification can be illustrated more clearly. Otherwise corresponding reference numerals have been applied to corresponding parts of Figure 10. The device 50 differs from that of Figure 10 in that a ferromagnetic element 70 in the form of a U-shaped piece of ferromagnetic material extends between the magnets 56 in the cylindrical magnet housing members 54. Also, the pair of magnets 56 are arranged so that the south pole of one magnet 56 forms or is adjacent the magnetic surface 57 of

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one housing member 54 and the north pole of the other magnet 56 forms or is adjacent the magnetic surface 57 of the other housing member 54.

In use, when the magnetic holding device 50 of Figure 11 is used to hold a piece of sheet material 14 to a steel structural member 60, a strong magnetic circuit is created in the U-shaped piece 70 of ferromagnetic material and in the steel structural member 60 which assists in holding the sheet material 14 more securely to the steel member 60.

The present invention thus provides an effective holding device and method for holding sheet materials to a structure whilst the preferred embodiment is described with reference to holding an insulating sheet to frame members of a steel framework of a building, the devices and method may also be used for holding other types of sheet material, such as shade cloth, hessian and even thin sheets of plyboard etc to structural members. It is also envisaged that the holding devices may have many other applications outside the building industry.

It will be appreciated that various other modifications may be made to the preferred embodiments described above without departing from the scope and spirit of the present invention. For instance, the retaining members on the holding device may be fixed to the housing of the device in a permanently extended position, although an adjustable retaining member is preferred for situations when it is not desirable to have a permanent retaining lip projecting from the housing.